Knowledge, awareness, attitudes and sources of vitamin D deficiency and sufficiency in Saudi children

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ABSTRACT

Objectives: To examine the awareness, knowledge, and attitudes regarding vitamin D and its sources among Saudi Arabian children.

Methods: One hundred patients (vitamin D-deficient children) and 100 healthy children participated in the study. Participants were interviewed separately on topics including their awareness, knowledge, and attitudes regarding vitamin D using multiple-choice, and short-answer questions. This prospective, cross-sectional study was performed on children and adolescents between January 2011 and December 2011 at the Security Forces Hospital, Riyadh, Saudi Arabia.

Results: Only 28% were aware of the sources of vitamin D, while 64% of healthy subjects were aware. Similarly, only 50% of patients and their parents knew of the health benefits of vitamin D, while 70% of healthy subjects had knowledge. Hence, our findings agree with previous findings that low levels of awareness and knowledge regarding vitamin D and its sources persist.

Conclusion: Most vitamin D deficient cases were unaware of vitamin D sources. However, half of the patient/parents were aware of benefits of vitamin D. Hence, we recommend that an improved campaign for awareness, knowledge, and attitudes regarding vitamin D and its sources are needed.

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Vitamin D deficiency is an unrecognized epidemic and a common health problem in children throughout the world, including Saudi Arabia. A high prevalence of vitamin D deficiency in Saudi children has been reported, with 25(OH)D levels of <20 ng/mL considered a relative deficiency and, <7 ng/mL considered a severe vitamin D deficiency.[1] Many healthy Saudi adults also suffer from severe vitamin D deficiency. A study on healthy Saudi adults revealed that vitamin D deficiency is common among the Saudi population.[2] Among adults, vitamin D sufficiency is defined as serum levels of 25(OH)D ≥30ng/ml, levels of 20-29 ng/ml are considered a vitamin D insufficiency, and levels <20ng/ml are considered a vitamin D deficiency.[3] Vitamin D deficiency may be detrimental to health, as contemporary evidence suggests health consequences for those with insufficient levels of serum vitamin D, compared to those with sufficient levels.[4] An insufficient titer of serum vitamin D has been linked with lower endurance capacity and muscle strength. In addition, it is well known that vitamin D plays a key role in bone health.[4] In our earlier study,[5] we found that 84% of children suffering from type-1 diabetes were vitamin D deficient. Moreover, the pattern of vitamin D deficiency was significantly proportional in female.[5] However, knowledge regarding vitamin D, and its potential implications for public health, is still nebulous within Saudi Arabia. It was hypothesized that awareness and knowledge of vitamin D may modulate vitamin D sufficiency in Saudi children. An understanding of the Saudi people's awareness, knowledge, and attitudes toward vitamin D could help guide interventions aimed at achieving adequate vitamin D status among the Saudi population. To achieve such an understanding, the children and their parents were questioned.

Sunlight is the best source of vitamin D, as its presence in food is limited. The ultraviolet (UV) B from sunlight initiates the production of vitamin D in the skin, by converting 7-dehydrocholesterol to pre-vitamin D.[7] Understanding the significance of sun exposure for synthesis of vitamin D is imperative. However, knowledge and understanding of skin cancer also influence vitamin D status.[6] Messages on sun safety are commonplace, due to high rates of skin cancer from sun exposure in countries such as Australia.[7] A study at King Abdulaziz University Hospital, Jeddah reported that out of 106 cases of skin cancer among Saudis: 28.3% were basal cell carcinoma; 24.5% were squamous cell carcinoma; 18% were mycosis fungoides; 10.3% were malignant melanoma; 5.7% were dermatofibrosarcoma protuberance; 2.8% were basosquamous cell carcinoma; and 1.9% were Kaposi sarcoma.[8] The site of distribution of basal cell carcinoma in the high sun-exposure area of Saudi Arabia suggests the effect of UV radiation contributes to the occurrence of skin cancer.[9]

Outdoor workers may have an increased risk of skin cancer compared to the general population. Often unable to find shade, these workers are compelled to spend many hours in the sun[10,11] wearing limited sun-protective clothing.[11] Furthermore, the effectiveness of their sunscreen is reduced by sweating.[11]

In contrast to the 'sun safety' message, information on vitamin D is not promoted as strongly as it should be. Consequently, the public's understanding of this area is much more limited. Before initiating educational programs, it is therefore necessary to understand the public's knowledge and concerns regarding vitamin D, including sources such as sun exposure. Therefore, the aim of this study is to examine the awareness, knowledge, and attitudes regarding vitamin D and its sources among Saudi Arabian children.

Methods. This prospective, cross-sectional study was performed on children and adolescents. It was carried out between January 2011 and December 2011 at the Security Forces Hospital in Riyadh, Saudi Arabia. A total of 200 children participated in the study (100 vitamin D deficiency [patients] and 100 healthy patients. The age ranged was 2-17 years. A written informed consent was obtained from the parents to confirm the participation. All children and their parents were also provided with a pre-designed questionnaire for this study. Ethical approval was obtained from the University Ethics Committee. This study was conducted according to the principles of the Helsinki Declaration (Ethical Principles for Medical Research Involving Human Subjects).

Participants were interviewed in private regarding awareness, knowledge, and attitudes to vitamin D using multiple-choice and short-answer questions.[12,13] In children <10 years, interviews were conducted with the parents. Participants' levels of vitamin D were tested during this study. Vitamin D deficiency was classified as 25(OH)D levels of 20-7 ng/mL.

Awareness of vitamin D was evaluated by asking participants (or their parents) if they had "ever heard of vitamin D". To assess their knowledge of vitamin D, participants (or their parents) were asked to "name a few benefits of vitamin D", and to list "any personal characteristics that may affect an individual's serum vitamin D levels". They were also asked, "What are the various sources of vitamin D?", and "Are you concerned about your vitamin D status?". A section of the questionnaire was designed to assess attitudes to sun exposure. This section included questions such as, "Do you go in the sun daily for more than an hour for any reason?", and "At which time of the day do you go out in the sun?". No information was disclosed to participants (or their parents), including whether their responses were correct. Furthermore, no help or prompts were offered by the interviewer.

Statistical analyses were utilized to determine the difference between patients' and healthy children's (or their parents') answers regarding knowledge of vitamin D, attitudes toward vitamin D, and sources of vitamin D. Within the groups, significant differences ($p < 0.05$) were found. Binomial probability tests were used to estimate the proportional differences between the answers provided by each group. Bonferroni adjustment was utilized for multiple comparisons. The Kruskal-Wallis test was implemented to determine differences between patients and healthy children for the questions related to knowledge and sources of vitamin D. The data in the present study is presented as the number of participants (percentage of that group of participants), unless otherwise stated. Statistical analysis was performed by the IBM SPSS Statistics for Windows version 20.0 (IBMCorp, Armonk, NY, USA).

Results. The mean age of the patient children was 10.2±4.2 years and for the healthy children was 10.09±4.09 years. Out of 100 patients, 59 were female and 41 were male, (with a mean age of 10.5±4.3) with 9.75±4.04. Seventeen female patients and 15 male patients were <10 years old. Among 100 healthy children, 62 were male with a mean age of 9.44 ± 3.65 and 38 were female, and with a mean age of 10.48 ± 4.31. Fourteen healthy females and 17 healthy males were <10 years old. e patient/parent cases answered YES for the question regarding their food behavior are schematically represented in **Figure 1**.

The characteristics of participants are shown in **Table 1**. Regarding knowledge of sources of vitamin D, there were differences between patients (28%) and healthy children (64%). Fifty percent of patients and 70% of healthy children had knowledge of vitamin D and its health implications. Most patients (88%) reported that they had heard of eggs as a dietary source of vitamin D, while only (36%) had heard of liver as a dietary source of vitamin D. Most participants were able to mention another source of vitamin D. Examples of the food sources identified by both patients and healthy children include: milk (88% and 96%); fish, sardines and tuna (50% and 76%); and leafy vegetables (72% and 72%). **Figures 2A & 2B** summarize the comparison between healthy children and patient children in terms

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Table 1 - The comparison between healthy and patient children in terms of knowledge of vitamin D, knowledge of vitamin D sources, and eating behavior of vitamin D sources.

Factor/group	Yes	No	Odds ratio	95% confidence intervals	*P*-value
Knowledge of vitamin D			2.3333	1.3062 - 4.1681	0.004
Patients	50	50			
Healthy children					
Knowledge of vitamin D sources	28	72	0.21	0.1203 - 0.3977	<0.0001
Patients	64	36			
Healthy children					
Eating eggs	88	12	0.3056	0.0950 - 0.9825	0.04
Patients	96	4			
Healthy children					
Eating liver	36	64	0.3164	0.1776 - 0.5637	0.0001
Patients	64	36			
Healthy children					
Drinking milk	88	12	0.3056	0.0950 - 0.9825	0.04
Patients	96	4			
Healthy children					
Eating sardines and tuna	50	50	0.3158	0.1727 - 0.5775	0.0002
Patients	76	24			
Healthy children					
Eating leafy vegetables	72	28	1	0.5394 - 1.8540	1
Patients	72	28			
Healthy children					

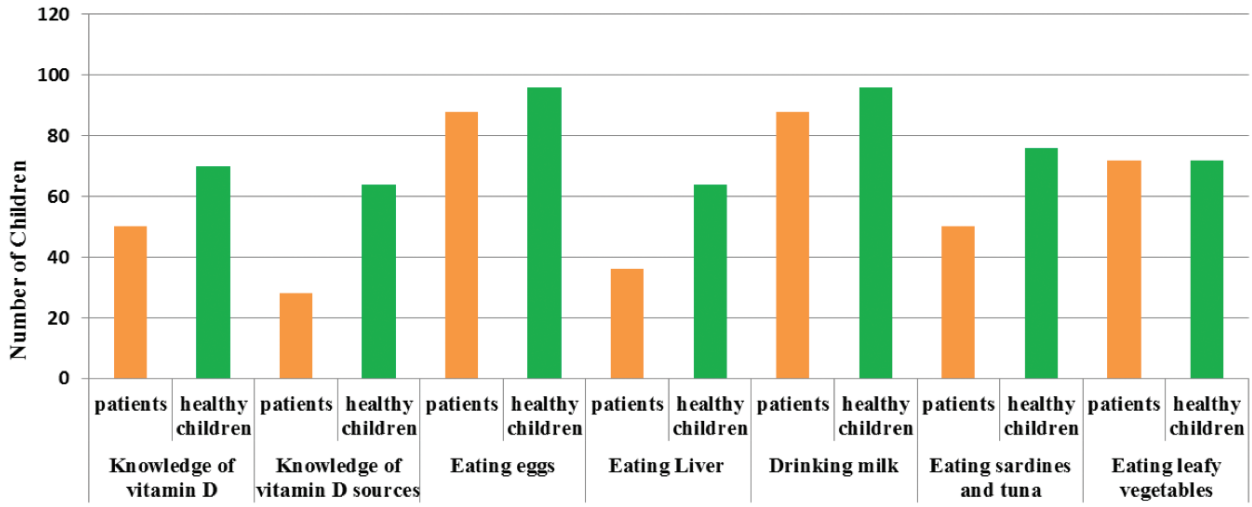

Figure 1 - Graphic representation of a comparison between healthy children and patients in terms of food behavior (for those whose answer was YES).

of sun exposure and timing of sun exposure. They also show the proportion of patients who intentionally spend time outside during sunset (n=18), the afternoon (n=34) and early morning (n=28) to improve their vitamin D status. Only 68.75% of patients, compared to 88.8% of healthy children, named the sun as a source of vitamin D.

Discussion. Vitamin D plays an important role in the maintenance of one's physiology and health. Nevertheless, only 50% of patients were aware of the health implications of vitamin D status, compared with 70% of healthy children. This finding was similar to other studies.[12,14] Previous study[15] reported that those with more information on the sources of vitamin D were inclined to consume more vitamin D-rich foods

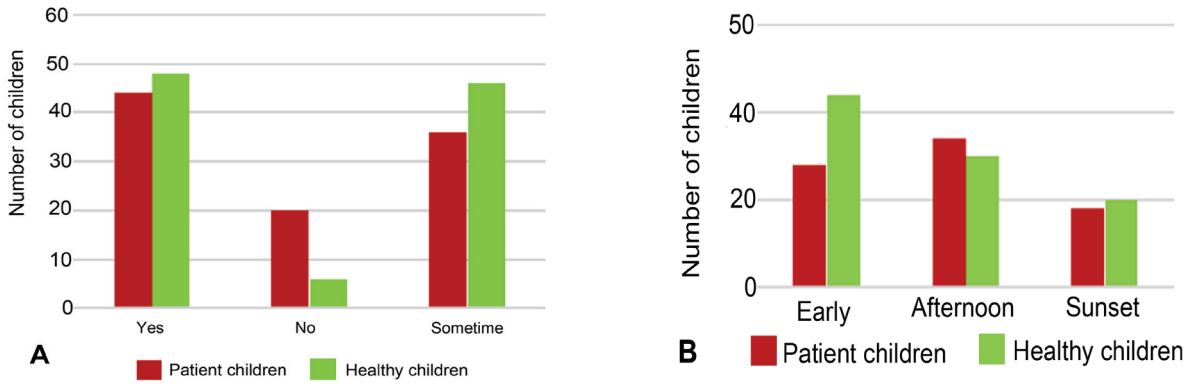

Figure 2 - Graphic representation of a comparison between healthy children and patients in terms of food behavior (for those whose answer was YES). A) healthy and patient children's exposure to sun and B) healthy and patient children's time of exposure to sun.

and supplements. In this study, we found those with more knowledge were more cautious about vitamin D. Probably those who understand the importance of vitamin D and health risks due to their deficiency motivate themselves with prospective precautionary solutions. Thus, public education regarding the importance of vitamin D and the risk of deficiency may increase concern on serum vitamin D titer at both the population and individual level. This awareness could lead to actions that potentially improve vitamin D levels through food, supplements, and safe sun exposure. Contemporarily, there is a lack of studies assessing the value of educational interventions on behavioral change and vitamin D levels.

Youl et al's study[14] found that 16% of participants intended to increase their sun exposure due to concerns on vitamin D status, while 21% had already changed their behavior. This practice could increase the risk of skin cancer, which is associated with sun exposure.[16] Adequate vitamin D levels cannot be maintained through food sources alone. However, consumption of certain foods could assist in cases of limited sun exposure.

Earlier studies have relied on open-ended questions,[12,14] which usually misjudged the participants' knowledge. In this study, we used a multiple-choice questionnaire. When participants were asked questions in this format they showed a better knowledge of vitamin D,[12-14] compared with those who were asked open-ended questions.[13,14] This demonstrates that the expression of knowledge regarding vitamin D is greatly dependent on the method of questioning. This fact was spotted by Kung and Lee,[13] who interviewed groups of Chinese women aged ≥50 years using either open-ended questions or prompted responses on vitamin D. They found that the type of questioning played a major role in proportionate outcome of correct responses.[12,14] However, one must be cautious when comparing studies, because results may be influenced by the 'sun smart' message distinct to each country.[17] It is necessary to mention that there is currently no 'sun smart' program in Saudi Arabia. Hence, we recommend that when the government launches a vitamin D awareness program, it should also launch a parallel program on safe sun exposure. Previous studies[2,5] demonstrated that the knowledge regarding vitamin D is poor, especially knowledge regarding potential sources of vitamin D.

This study had a number of limitations, such as (i) small sample size, (ii) children aged <10 years, and (iii) several illiterate parents. These factors may affect the findings. Since the sample size was very small, if we had categorized the data for number of children and parents completing the questionnaires for age groups and gender separately, there would be a good chance of inappropriate statistical prediction. Hence, we omitted those categorizations during data analysis. However, despite of these shortcomings, we obtained information on the knowledge and awareness of vitamin D among the Saudi population.

In conclusion, the public should be educated to improve their knowledge, awareness, and attitudes regarding vitamin D and its sources. This information should be provided in conjunction with messages on preventative measures to ensure people do not increase their risk of skin cancer in an attempt to improve their vitamin D levels through excessive sun exposure. We strongly recommend that these findings are used in health policy-making. Non-government organizations and social workers may collaborate with the government to educate parents and children regarding the uses and

benefits of vitamin D. This will help to improve overall health among the Saudi population.

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References

1. Mansour MM, Alhadidi KM. Vitamin D deficiency in children living in Jeddah, Saudi Arabia. ***Indian J Endocrinol Metab*** 2012; 16: 263.
2. Alsuwaida AO, Farag YM, Al Sayyari AA, Mousa DH, Alhejaili FF, Al-Harib AS, et al. Prevalence of vitamin D deficiency in Saudi adults. ***Saudi Med J*** 2013; 34: 814-818.
3. Naeem Z, AlMohaimeed A, Sharaf FK, Ismail H, Shaukat F, Inam SB. Vitamin D status among population of Qassim Region, Saudi Arabia. ***Int J Health Sci (Qassim)*** 2011; 5: 116-124.
4. Foo LH, Zhang Q, Zhu K, Ma G, Hu X, Greenfield H, et al. Low vitamin D status has an adverse influence on bone mass, bone turnover, and muscle strength in Chinese adolescent girls. ***J Nutr*** 2009; 139: 1002-1007.
5. Alshamsan F, Elgabry E, Bin-Abbas B. Vitamin D deficiency is comparatively more prevalent in female children with type 1 diabetes in a high vitamin d deficiency risk country. ***Middle East Journal of Family Medicine*** 2014; 7: 31.
6. Engelsen O. The relationship between ultraviolet radiation exposure and vitamin D status. ***Nutrients*** 2010; 2: 482-495.
7. Bonevski B, Bryant J, Lambert S, Brozek I, Rock V. The ABC of Vitamin D: A qualitative study of the knowledge and attitudes regarding vitamin d deficiency amongst selected population groups. ***Nutrients*** 2013; 5: 915-927.
8. Mufti ST. Pattern of skin cancer among Saudi Patients who attended King AbdulAziz University Hospital between Jan 2000 and Dec 2010. ***Journal of the Saudi Society of Dermatology & Dermatologic Surgery*** 2012; 16: 13-18.
9. Al-Maghrabi JA, Al-Ghamdi AS, Elhakeem HA. Pattern of skin cancer in Southwestern Saudi Arabia. ***Saudi Med J*** 2004; 25: 776-779.
10. Herlihy E, Gies PH, Roy CR, Jones M. Personal dosimetry of solar UV radiation for different outdoor activities. ***Photochem Photobiol*** 1994; 60: 288-294.
11. Moehrle M. Outdoor sports and skin cancer. ***Clin Dermatol*** 2008; 26: 12-15.
12. Vu LH, van der Pols JC, Whiteman DC, Kimlin MG, Neale RE. Knowledge and attitudes about vitamin D and impact on sun protection practices among urban office workers in Brisbane, Australia. ***Cancer Epidemiol Biomarkers Prev*** 2010; 19: 1784-1789.
13. Kung AW, Lee KK. Knowledge of vitamin D and perceptions and attitudes toward sunlight among Chinese middle-aged and elderly women: a population survey in Hong Kong. ***BMC Public Health*** 2006; 6: 226.
14. Youl PH, Janda M, Kimlin M. Vitamin D and sun protection: the impact of mixed public health messages in Australia. ***Int J Cancer*** 2009; 124: 1963-19670.
15. Toher C, Lindsay K, McKenna M, Kilbane M, Curran S, Harrington L, et al. Relationship between vitamin D knowledge and 25-hydroxyvitamin D levels amongst pregnant women. ***J Hum Nutr Diet*** 2014; 27: 261-269.
16. Moehrle M, Heinrich L, Schmid A, Garbe C. Extreme UV exposure of professional cyclists. ***Dermatology*** 2000; 201: 44-45.
17. Dixon H, Warne C, Scully M, Dobbinson S, Wakefield M. Agenda-setting effects of sun-related news coverage on public attitudes and beliefs about tanning and skin cancer. ***Health Commun*** 2014; 29: 173-181.